Electron fluxes interacting with localized oblique whistler mode waves in the Earth’s outer radiation belt

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Oblique whistler mode waves are observed frequently in dayside and dawnside of the Earth’s magnetosphere around the outer radiation belt. Through the nonlinear trapping, by coherent chorus waves, energetic resonant electrons (tens keV) can be accelerated rapidly and become relativistic electrons (a few MeV). Electron acceleration of velocity perpendicular to the background magnetic field of resonant electrons plays an important role in both cyclotron and Landau resonances. Green’s functions are treated as the results of wave-particle interactions between the target waves and the given electrons. We build up a database of Green’s functions for a large number of electrons interacting with oblique whistler mode chorus emissions. The formation processes of the outer radiation belt electron fluxes interacting with consecutive chorus emissions are traced by applying the convolution integrals for the Green’s functions. We trace the evolution of the radiation belt electron fluxes for a few minutes and find that MeV electrons are generated promptly due to the combination of cyclotron resonance and Landau resonance with oblique chorus waves. We compare the formation processes among waves with different wave normal angles, and the results show that chorus waves with larger wave normal angles can accelerate 10-30 keV electrons to MeV faster. We further trace the formation processes of MeV electron fluxes for oblique chorus emissions localized in longitude for an hour, and then compare the results among several different longitudinal ranges. The acceleration rate of electrons is highly related to the longitudinal range of chorus occurrence.

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